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Editorial

Computational Intelligence in Wireless Sensor and Ad Hoc Networks

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Multihop wireless sensor network is a mature research field that covers many topics and different classes of networks. Despite previous results and a vast literature on the topic, many problems related to modern network infrastructures such as coverage, deployment, routing, broadcasting, mobility, and energy consumption are still challenging, as solving them to optimality is certainly far from easy. Additionally, the desirable performance features are usually in conflict, meaning that tuning the network to improve one of them will negatively impact others. This difficulty, together with the high number of network parameters involved and their multiple dependencies, advises using computational intelligence optimization algorithms. These tools perform an efficient search on large spaces thanks to the good exploration and exploitation behaviors they provide. Therefore, they allow exploring accurate solutions beyond the knowledge of the network designer, learning the properties of the environment, and adapting their behavior to the changing conditions.

The scope of our special issue is to encourage new research and developments in the field. We open the special issue with a survey that addresses the main aspects of the application of evolutionary algorithms in mobile multihop networks. First, an introduction on mobile multihop networks (MANETs, VANETs, and DTNs) is given, and after that the survey focuses on the application of evolutionary algorithms to multihop related problems. Relevant existing work for each type of mobile multihop network and some future work and open challenges are mentioned at the end. We expect this survey will help new researchers to have an overview of the field and rapidly contribute with new research and developments.

The paper "An Intelligent Strategy for Tactical Movements of UAVs in Disaster Scenarios" proposes an interesting approach for decision making of tactical movements of UAVs in disaster scenarios. Both simulated annealing algorithm and a dissimilarity metric like the Jaccard distance are used to decide the next movements of UAVs in order to maximize the number of covered victims in the disaster area. A new mobility model for disaster scenarios is employed for the evaluation of the proposed tactical movements.

In "An Efficient Large-Scale Sensor Deployment Using a Parallel Genetic Algorithm Based on CUDA," a genetic algorithm is used to solve a deployment problem of wireless sensor networks in battlefield environments. In order to importantly reduce the computing time to find a solution, the authors implemented a massively parallel genetic algorithm for CUDA (standing for Compute Unified Device Architecture). The obtained simulation results demonstrate that the computing time can be reduced to 55-56 times when applying the proposed CUDA.

A Monte Carlo based tracking application for wireless sensor networks is proposed in "NMCT: A Novel Monte Carlo-Based Tracking Algorithm Using Potential Proximity Information." The approach uses both area-based and neighbor-based filtering to solve the main problems of traditional methods like the requirement of a high number

of anchors. This work also compares the proposed NMCT method versus other typical algorithms used in wireless sensor scenarios.

The paper "Modeling of Multihop Wireless Sensor Networks with MAC, Queuing, and Cooperation" presents a Markovian decision process (MDP) framework for multihop wireless sensor networks (MHWSNs). The proposed framework is evaluated in two types of MHWSNs such as energy constrained (EC) networks and energy harvesting (EH) networks. From the presented analysis of both networks, it can be observed that EC and EH networks fall into two branches of MDP theory, which are finite-horizon process and infinite-horizon process, respectively.

Finally, Multiattribute Routing Scheme (MARS) routing protocol for opportunistic networks is presented in "Resource Aware Routing in Heterogeneous Opportunistic Networks." The protocol uses neural networks to learn rules. The main objective of MARS is to use Simple Multiattribute Rating Technique (SMART) in order to maximize node's utility and to improve the delivery of packets in real and synthetic trace-based opportunistic scenarios.

The work presented in this special issue aims to contribute and stimulate the research on the application of computational intelligence techniques to the multihop ad hoc networks field, where more work is needed to understand the dependencies of the network performance on the network parameters.

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